

POST AND BEAM FURNITURE SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

The present application is related to commonly assigned, copending U.S. Patent Application Serial No. \_\_\_\_\_, filed \_\_\_\_\_, entitled IN-  
5 FILL PANEL ARRANGEMENT FOR POST AND BEAM FURNITURE SYSTEMS, as well as U.S. Patent Application Serial No. \_\_\_\_\_, filed \_\_\_\_\_, entitled EXTERNAL UTILITIES MANAGER FOR POST AND BEAM FURNITURE SYSTEMS, which are hereby incorporated herein by reference.

BACKGROUND OF THE INVENTION

10 The present invention relates to furnishings for open office space and the like, and in particular to a post and beam furniture system.

15 Portable partition systems for open office spaces and other similar settings are well known in the art. Individual partition panels are interconnected in different configurations to form separate offices, workstations and/or work settings. The partition panels are extremely durable and can be readily disassembled and reassembled into alternative configurations to meet the ever-changing needs of the user. Examples of such partition systems are provided in U.S. Patent Nos. 3,822,146; 3,831,330; and 4,144,924, which are owned by Steelcase Development Inc., the assignee of the present application.

20 Post and beam furniture systems have also been developed to divide open plans three dimensionally into individual workstations and/or work settings. Examples of such furniture systems are provided in U.S. Patents 6,003,275; 5,950,371; and 5,889,025, which are also owned by Steelcase Development Inc., the assignee of present application.

Changing technology and changing work processes demand that current office furnishings be readily adaptable to efficiently support the ever-changing needs of workers, such that the quick and easy reconfigurability of the furniture system is desired to meet these needs.

### SUMMARY OF THE INVENTION

5 One aspect of the present invention is a post and beam furniture system for partitioning open office space and the like, comprising a plurality of overhead beams, each having opposite ends. The furniture system also includes a plurality of vertical posts, each having a lower portion thereof adapted to be abuttingly supported on a floor surface of the open office space, an upper portion thereof adapted to be connected with an associated one of the overhead beams, and at least one outwardly extending flange, having an end face with a  
10 single vertical slot extending centrally therealong. A plurality of post-to-beam connectors are attached to the opposite ends of the beams, and are detachably retained in the slots in the posts for mounting the beams on the posts.

Another aspect of the present invention is a post-to-beam connector for post and beam furniture systems of the type having a plurality of overhead beams with slots extending along uppermost and lowermost faces thereof, and a plurality of vertical posts having at least one outwardly extending flange with a vertical slot extending along an end face thereof. The post-to-beam connector includes an elongate T-shaped central portion adapted to be attached to an end of an associated one of the beams, and configured to be closely received in the slot in  
15 the upper portion of an associated one of the posts. Upper and lower key portions project inwardly from the central portion, are shaped for close reception in the slots in the uppermost and lowermost faces of the associated beam, and include horizontally extending fastener apertures therethrough. A pair of T-fasteners have shank portions thereof mounted in the  
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fastener apertures in the upper and lower key portions, and T-shaped nut portions threadedly connected with the shank portions, and closely received in the slot of the associated post, such that tightening the T-fasteners draws the end of the beam and the post together to securely, yet detachably, interconnect the same.

5 Yet another aspect of the present invention is a post and beam furniture system for partitioning open office space and the like, comprising a plurality of overhead beams, each having opposite ends, and a lowermost face with a single horizontal slot extending centrally therealong. The furniture system also includes a plurality of vertical posts, each having a lower portion thereof adapted to be abuttingly supported on a floor surface of the open office space, and an upper portion thereof adapted to be connected with an associated one of the overhead beams. The posts include at least one X-post having an X-shaped plan configuration defining four mutually perpendicular, outwardly extending flanges, each of which has an end face with a single vertical slot extending centrally therealong. The posts also include at least one Y-post having a Y-shaped plan configuration defining three regularly spaced apart, outwardly extending flanges, each of which has an end face with a single vertical slot extending centrally therealong. A plurality of post-to-beam connectors are attached to the opposite ends of the beams, and are detachably retained in slots in the posts for mounting the beams on the posts. A plurality of partition accessories are configured to equip the furniture system for users, and have mounts shaped to be detachably retained in the slots in the posts and the beams. Each of the slots in the posts and each of the slots in the beams is generally similar in size and shape to receive a common fastener therein, and defines an integrated universal mounting arrangement in the furniture system for detachably interconnecting the posts and the

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beams in alternative configurations, and mounting the accessories at a variety of different locations.

Yet another aspect of the present invention is an X-post for post and beam furniture systems of the type having a plurality of overhead beams, and a plurality of vertical posts, each having a lower portion thereof adapted to be abuttingly supported on a floor surface of an open office space, and an upper portion thereof adapted to be connected with an associated one of the overhead beams. The X-post has an X-shaped plan configuration defining four mutually perpendicular, outwardly extending flanges, each of which has an end face with a single vertical slot extending centrally therealong for detachably interconnecting the posts and the beams in alternative configurations, and for mounting accessories at a variety of different locations.

The principle objects of the present invention are to provide a post and beam furniture system that can be quickly and easily installed and reconfigured to efficiently and effectively support the ever-changing needs of the user. The individual posts and beams are equipped with T-shaped slots which define an integrated universal mounting arrangement for detachably interconnecting the posts and beams in alternative configurations, and mounting accessories at a variety of different locations. The furniture system is efficient in use, economical to manufacture, capable of a long operating life and particularly well adapted for the proposed use.

These and other advantages of the invention will be further understood and appreciated by those skilled in the art by reference to the following written specification, claims and appended drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a post and beam furniture system embodying the present invention.

Fig. 2 is a partially schematic top plan view of a post and beam furniture system  
5 embodying the present invention.

Fig. 3 is a top plan view of an X-post portion of the furniture system.

Fig. 4 is a fragmentary front elevational view of the X-post shown in Fig. 3.

Fig. 5 is a top plan view of a Y-post portion of the furniture system.

Fig. 6 is a fragmentary front elevational view of the Y-post shown in Fig. 5,  
10 with a portion thereof broken away to reveal internal construction.

Fig. 7 is an enlarged fragmentary cross-sectional view of a flange portion of the  
X-post.

Fig. 8 is an enlarged fragmentary cross-sectional view of a hanger slot portion  
of a beam portion of the furniture system.

Fig. 9 is an enlarged fragmentary cross-sectional view of an internal boss  
portion of the beam.

Fig. 10 is an enlarged fragmentary cross-sectional view of a bottom slot portion  
of the beam.

Fig. 11 is a perspective view of an adjustable foot portion of the X-post.

Fig. 12 is a front elevational view of a retainer plate for the adjustable foot.  
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Fig. 13 is an enlarged lateral cross-sectional view of the retainer plate.

Fig. 14 is an enlarged longitudinal cross-sectional view of the retainer plate.

Fig. 15 is a horizontal cross-sectional view of a lower portion of the X-post with the adjustable foot mounted therein, taken along the line XV-XV, Fig. 16.

Fig. 16 is a perspective view of the X-post with the adjustable foot mounted therein.

5 Fig. 17 is an end elevational view of the beam.

Fig. 18 is a fragmentary top plan view of the beam.

Fig. 19 is a fragmentary side elevational view of the beam.

Fig. 20 is a fragmentary bottom plan view of the beam.

Fig. 21 is a front elevational view of a post-to-beam connector portion of the furniture system.

Fig. 22 is a top plan view of the post-to-beam connector.

Fig. 23 is a side elevational view of the post-to-beam connector.

Fig. 24 is a bottom plan view of the post-to-beam connector.

Fig. 24A is an exploded perspective view of the post-to-beam connector being connected with an associated beam and post.

Fig. 25 is a side elevational view of the post-to-beam connector attached to an end of an associated beam.

Fig. 26 is fragmentary top plan view of a beam and post-to-beam connector shown attached to an associated post.

20 Fig. 27 is a fragmentary side elevational view of the beam and post-to-beam connector shown attached to an associated post.

Fig. 28 is an enlarged vertical cross-sectional view of an upper portion of the post-to-beam connector assembly shown in the circle XXVII, Fig. 27.

Fig. 28A is an enlarged fragmentary vertical cross-sectional view of the upper portion of the post-to-beam connector assembly, taken along the lint XXVIII A-XXVIII A, Fig. 28.

Fig. 29 is an enlarged vertical cross-sectional view of a lower portion of the post-to-beam connector assembly shown in the circle XXIX, Fig. 27.

Fig. 30 is a front perspective view of a T-fastener portion of the present invention.

Fig. 31 is a rear perspective view of the T-fastener shown in Fig. 30.

Fig. 32 is a top plan view of a post shown with a vertical external utilities manager accessory mounted thereon.

Fig. 33 is a vertical cross-sectional view of a beam shown with a horizontal external utilities manager accessory mounted thereon.

Fig. 34 is an exploded perspective view of a top end in-fill panel bracket accessory.

Fig. 35 is a top plan view of a post with the top end in-fill panel bracket accessory mounted thereon.

Fig. 36 is an exploded perspective view of a top center in-fill panel bracket accessory.

Fig. 37 is a vertical cross-sectional view of a beam with the top center in-fill panel bracket accessory mounted thereon.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

For purposes of description herein, the terms “upper”, “lower”, “right”, “left”, “rear”, “front”, “vertical”, “horizontal” and derivatives thereof shall relate to the invention as

oriented in Fig. 1. However, it is to be understood that the invention may assume various alternative orientations and step sequences, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in following specification, are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be construed as limiting, unless the claims expressly state otherwise.

The reference numeral 1 (Fig. 1) generally designates a post and beam furniture system embodying the present invention. The post and beam furniture system includes a plurality of overhead beams 2, and a plurality of vertical posts 3 having at least one outwardly extending flange 4 with a single slot 5 extending vertically along the end face of flange 4. Beam-to-post connectors 6 are attached to the opposite ends of beams 2, and are detachably retained in the slot 5 in posts 3 to mount beams 2 on the upper ends of posts 3.

As shown in Figs. 3-6, in the illustrated furniture system 1, posts 3 include an X-shaped post 3a and a Y-shaped post 3b, which are substantially identical in construction. X-shaped post 3a has four mutually perpendicular outwardly extending flanges 4a, each of which has a flat end face 10a with a single vertical slot 5a extending centrally therealong. As best illustrated in Fig. 7, each of the slots 5 has a generally T-shaped lateral cross-sectional configuration with an enlarged interior track portion 11 and a reduced neck portion 12 which opens outwardly. The illustrated posts 3 have a hollow interior 13 with inwardly projecting reinforcing ribs 14, and an end web 54 in each flange 4 that defines the base of slot 5.



The illustrated Y-shaped post 3b is substantially identical to the previously described X-shaped post 3a, except that it has only three flanges 4b which are spaced 120 degrees apart.

In the illustrated examples of the present invention, posts 3 have a uniform cross-sectional shape along their length and may be constructed from extruded aluminum or the like, such that the bases 20 of posts 3 are hollow. As shown in Figs. 11-14, adjustable leveling feet 21 may be telescopically received in the hollow bases 20 of posts 3 to facilitate leveling furniture system 1. Each of the adjustable leveling feet 21 includes a base plate 22 shaped to abut the floor surface, and an upright 23 connected with and upstanding from base plate 22, and shaped to be closely received in the hollow base 20 of an associated one of the posts 3. Retainer plates 24 are shaped to be received in the slot 5 at the lowermost end of post 3, and fasteners 25 extend laterally through retainer plates 24 and into upright 23 to securely, yet detachably, retain leveling foot 21 at its desired position.

In the example shown in Figs. 11-16, base plate 22 has a square plan shape, and includes four vertical apertures 26 positioned adjacent the corners thereof through which floor anchors 27 are inserted to positively attach leveling foot 21 to an associated floor surface. Four bolts 28 extend through four vertically oriented central apertures 29 in base plate 22 to attach base plate 22 to the bottom of upright 23. The illustrated upright 23 has an X-shaped top plan configuration with four outwardly protruding mutually perpendicular flanges 30 that are closely received within the interior 13 of the associated post 3 and contact the end surfaces of reinforcing ribs 14 to provide vertical alignment. Vertically elongated slots 31 (Figs. 4 and 6) are provided in the end web 54 of each post flange 4, and are shaped to receive fasteners 25 therethrough. The illustrated retainer plate 24 (Figs. 11-14) has a generally rectangular front

elevational configuration with a pair of fastener apertures 32 disposed adjacent opposite ends thereof. As best illustrated in Fig. 13, fastener apertures 32 are countersunk, and the interior edges 33 of retainer plate 24 are beveled. The interior face 34 (Fig. 14) of each of the illustrated retainer plates 24 is serrated to assist in engaging the end web 54 of the associated post flange 4.

Y-shaped posts 3b also have adjustable leveling feet 21, which are identical to the leveling feet described above for use with the X-shaped posts 3a, except that the uprights are Y-shaped, and the base plates are circular.

In operation, the base plate 22 for each of the leveling feet 21 is first attached to the lower end of the associated upright 23 by bolts 28. Upright 23 is then inserted into the lower hollow base 20 of the associated post 3. Retainer plates 24 are inserted into the slots 5 of each post flanges 4 through the lower open end thereof, as shown in Fig. 16, and fasteners 25 are inserted through apertures 32 at the opposite ends of retainer plates 24, and threadedly engaged in mating threaded apertures (not shown) in upright 23, as shown in Fig. 15. The selected post 3 is then positioned at the desired location on the floor surface, and floor anchors 27 are installed to positively retain the leveling foot 21 and post 3 in place. With fasteners 25 loosened, the selected post 3 is then elevated to a position at which the posts 3 and associated beams 2 are level. The leveling can be achieved by using a tool, such as that disclosed in related, commonly assigned copending U.S. Patent Application Serial No. 09/694,645, filed October 23, 2000, entitled LEVELING SYSTEM FOR POST AND BEAM FURNITURE SYSTEMS AND THE LIKE, which is hereby incorporated herein by reference. It is to be understood that other types of leveling arrangements can also be used, as would be understood by one having skill in the art. After the posts 3 and associated beams 2 have been leveled,

fasteners 25 are then tightened to securely retain the leveling feet 21, posts 3 and beams 2 in the level condition.

The illustrated beams 2 include opposite ends 40 to which beam-to-post connectors 6 are attached. With reference to Figs. 17-20, beams 2 have a generally rectangular vertical cross-sectional shape defining a lower face 42, an upper face 43, and opposite sides faces 44 and 45. A slot 46 extends along the lowermost face 42 of beam 2, and has a generally T-shaped lateral cross-sectional configuration with an enlarged interior track portion 47 (Fig. 10) and a reduced neck portion 48 which opens outwardly. Slot 46 is substantially identical in size and shape to the slot 5 in post 3, except that it is somewhat deeper to closely receive therein an associated portion of beam-to-post connector 6 therein, as described below. The uppermost face 43 (Figs. 17-20) of beam 2 also has a single horizontal slot 49 extending centrally therealong, which is identical in size and shape to slot 46. The opposite side faces 44 and 45 of beam 2 include hanger slots 50 and 51, which extend horizontally therealong a predetermined distance above the lowermost face 42, and are adapted to support accessories therefrom, such as white boards, privacy panels, lighting, etc. Slots 50 and 51 have a T-shaped lateral cross-sectional configuration that is identical in shape and size to the previously described slots 5 in posts 3. Integrally formed bosses 52 are also provided in the illustrated beam 2 to facilitate attachment of post-to-beam connectors 6 to the opposite ends 40 thereof. In the illustrated example, each of the beams 2 has an integral one-piece construction, preferably made from extruded aluminum or the like, wherein bosses 52 are attached to laterally extending internal ribs 53, and an uppermost end web 55 extends along the bottom of slot 49, and a lowermost end web 56 extends along the bottom of slot 46.

With reference to Figs. 21-29, the illustrated post-to-beam connectors 6 each have an elongate T-shaped central portion 60 that is adapted to be attached to the end 40 of an associated one of the beams 2, and closely received in the slot 5 at the upper portion of the associated post 3. In the illustrated example, the central portion 60 of beam-to-post connector 6 includes three horizontally extending fastener apertures 61 which are vertically aligned in a spaced apart pattern which matches the pattern of bosses 52 in beam 2. As shown in Fig. 25, fasteners 62 extend through apertures 61 into the fastener apertures 57 formed by bosses 52 to attach beam-to-post connector 6 to an associated end 40 of beam 2. As best illustrated in Fig. 24, the side edges 63 of central portion 60 are beveled to facilitate insertion in an associated slot 5. Each beam-to-post connector 6 has a length that is substantially identical to the height of the associated beam 2, as shown in Fig. 25. Beam-to-post connectors 6 also include upper and lower key portions 64 and 65 which project inwardly from central portion 60, and are shaped to be closely received in the slots 49 and 46 in the uppermost and lowermost faces 43 and 42 of beam 2. The illustrated key portions 64 and 65 have a generally rectangular plan configuration, and include laterally extending fastener apertures 66 and 67 extending horizontally therethrough. The upper end of post-to-beam connector 6 includes an outwardly projecting stop 68 which is configured to abut the uppermost end of an associated one of the posts 3 to locate and retain the beam 2 at the upper portion of the post 3 in the manner described in greater detail hereinafter. As best illustrated in Fig. 22, stop 68 is in the form of a flat plate having a rectangular top plan configuration, wherein the outermost edge 69 extends to a location directly above the central portion 60, and innermost edge 70 is positioned a spaced apart distance away from the end of upper key portion 64.

To attach the end of a beam 2 to an associated post 3, a beam-to-post connector 6 is attached to the end 40 of the beam 2 in the manner described hereinabove using fasteners 62. The post-to-beam connector 6 is then inserted into the slot 5 at the uppermost end of post 3, and slid vertically downwardly until stop 68 abuts the top surface of post 3, thereby positioning beam 2 in proper alignment with post 3. A pair of T-fasteners 74 (Fig. 24A) are then assembled on post-to-beam connector 6 to securely mount the beam 2 on post 3 as described below. Each of the T-fasteners 74 (Fig. 24A) has a screw 75 with a threaded shank portion that is received in an associated one of the horizontal fastener apertures 66 and 67 in upper and lower key portions 64 and 65 of post-to-beam connector 6. Each of the T-fasteners 74 also includes a T-nut 76 which is shaped to be closely received in the post slot 5, and includes a central threaded aperture 77 in which the free end of the fastener screw 75 is threadedly received. The illustrated T-nut 76 has a substantially square plan configuration, with beveled outer edges 78 that facilitate insertion into post slot 5. The illustrated screws 75 are in the form of allen head bolts, and include a cylindric head 79 with a tool receiving recess 80 in the outer end thereof. The tightening of bolts 75 draws the end of the beam 2 and the associated post 3 together to securely, yet detachably, interconnect the same.

As previously noted, the slots 5 in posts 3 and the slots 46, 49, 50 and 51 in beams 2 are generally similar in size and shape to receive a common fastener therein, and define an integrated universal mounting arrangement for furniture system 1. More specifically, the slots 5 in posts 3, and the hanger slots 50 and 51 in beams 2 are identical in both size and shape. The upper and lower slots 49 and 46 in beams 2 are identical in size and shape to the slots 5, 50 and 51, except that they are slightly deeper to accept therein the key portions 64 and 65 of post-to-beam connectors 6. For example, in one working embodiment of

the present invention, the track portion of slots 5, 50 and 51 is around 0.50" wide and 0.25" deep, whereas the track portion of slots 50 and 51 is around 0.50" wide and 0.40" deep. The neck portion 12 of slots 5, 50 and 51 is identical in both size and shape to the neck portion 48 of slots 49 and 46. As described in greater detail below, the slightly deeper slots 49 and 46 of beams 2 not only permit the close reception of post-to-beam connector key portions 64 and 65, but also permit the use of commonly shaped T-fasteners 100 throughout the furniture system 1 to mount a wide variety of accessories 90 thereon.

As best illustrated in Fig. 1, a plurality of partition accessories, which are generally designated by the reference numeral 90, are provided to equip post and beam furniture system 1 for a variety of different users and tasks.

In-fill panels 95 may be mounted on posts 3 and beams 2 by an accessory 90, comprising a set of brackets 96 that are supported in the slots 5 of posts 3 and lowermost slots 46 of beams 2, as disclosed in greater detail in related Application Serial No.

\_\_\_\_\_, filed \_\_\_\_\_, entitled IN-FILL PANEL ARRANGEMENT FOR POST AND BEAM FURNITURE SYSTEMS. Figs. 34 and 35 illustrate a top side in-fill panel bracket 101 that is mounted in the slot 5 of an adjacent post 3 by a T-fastener 100. The illustrated T-fastener includes a T-nut 102 similar to T-nut 76, having beveled side edges 103 and a central threaded aperture 104. T-nut 102 has an outwardly protruding rib 105 shaped for close reception in the neck portion 12 of post slot 5, and the body portion of T-nut 102 is shaped for close reception in the track portion 11 of post slot 5, as shown in Fig. 35. The illustrated T-fastener 100 (Fig. 34) also includes a threaded screw 106 shaped for threaded engagement in T-nut aperture 104, and having a round slotted head 107. As shown in Figs. 34 and 35, top side in-fill panel bracket 101 is attached to post 3

by inserting T-nut 102 into post slot 5, inserting screw 106 through an aperture 108 in the upstanding portion of the bracket 101, and threadedly engaging the free end of screw 106 in T-nut aperture 104. By tightening screw 106, bracket 101 is retained securely in the desired location on post 3, yet can be readily detached.

5 Figs. 36 and 37 illustrate a top center in-fill panel bracket 111 that is mounted in the lower slot 46 on an adjacent beam 2 by a T-fastener 100. It is to be understood that the specific length and head shape of screw 106 may be varied to accommodate a particular application. Bracket 111 attaches to beam 2 in a manner similar to the attachment of bracket 101 to post 3. As best illustrated in Fig. 37, while the lower slot 46 of beam 2 is deeper than the slot 5 in post 3, T-nut 102 is still received and retained securely in slot 46 since T-nut rib 105 is closely received in the neck portion 48 of slot 46, and the width of T-nut 102 is commensurate with the width of the track portion 47 of slot 46. By tightening screw 106, T-nut 102 is drawn firmly against the interior of the flanges defining slot 46 to securely, yet removably, mount bracket 111 to the lower face 42 of beam 2.

10 Accessories 90 may also include an external utilities manager, as disclosed in related Application Serial No. \_\_\_\_\_, filed \_\_\_\_\_, entitled EXTERNAL UTILITIES MANAGER FOR POST AND BEAM FURNITURE SYSTEMS. Fig. 32 illustrates the attachment of vertical utilities manager 112 to an associated post 3 using T-fasteners 100 in a manner similar to the mounting of top side in-fill panel bracket 101 to post 3. Fig. 33 illustrates the attachment of a horizontal utilities manager 113 to the upper face of an associated beam 2 using T-fasteners 100 in a manner similar to the mounting of top center in-fill panel bracket 111 to the lower face of beam 2.

U-shaped ambient lights 97 (Fig. 1) may be routed along the top of beams 2 and supported by T-fasteners 100 retained in the upper slot 49 of beams 2. Wing-shaped workstation lights 98 may also be positioned at various locations throughout furniture system 1, and are supported by T-fasteners 100 mounted in the hanger slots 50 and 51 of beams 2.

5 In the example illustrated in Fig. 1, a white board 91 is provided with hooks 92 shaped to be received in the hanger slots 50 and 51 of beam 2 to hang white board 91 at a variety of different locations from beams 2. A partial height partition panel 93 has one side edge thereof connected with an associated post 3 by T-fasteners 100. The opposite side of the partial height partition panel 93 includes a floor engaging foot 94 to support the same on the floor surface.

Other similar accessories 90 may also be integrated into furniture system 1 through the universal mounting arrangement, such as the cantilevered beam panel support brackets and panel-to-post brackets disclosed in related Application Serial No. 09/694,296, filed October 23, 2000, entitled CANTILEVERED SUPPORT FOR FURNITURE BEAM. As will be understood by one having ordinary skill in the art, the universal mounting system associated with post and beam furniture system 1 may be used to integrate other accessories 90 as well.

In the foregoing description, it will be readily appreciated by those skilled in the art that modifications may be made to the invention without departing from the concepts disclosed herein. Such modifications are to be considered as included in the following claims, unless these claims by their language expressly state otherwise.